

can be secured to the arm or stowed in a pocket on the arm when not in use.

(h) *Retroreflective material.* Each thermal protective aid must be fitted with at least 200 cm<sup>2</sup> (31 sq. in.) of Type I retroreflective material that meets subpart 164.018 of this chapter.

(i) *Size.* Each thermal protective aid must fit persons ranging in weight from 50 kg. (110 lbs.) to 150 kg. (330 lbs.) and in height from 1.5 m. (59 in.) to 1.9 m. (75 in.).

(j) *Lifejacket.* Each thermal protective aid must be designed so that any Type I Personal Flotation Device meeting the requirements of this chapter can be worn inside the aid and, when worn, will not damage the aid and will not adversely affect its performance.

#### § 160.174-11 Performance.

(a) *Thermal protection.* The thermal protective aid must be designed to protect against loss of body heat as follows:

(1) The thermal conductivity of the material from which the thermal protective aid is constructed must be not more than 0.25 W/(m-°K).

(2) The thermal protective aid must prevent evaporative heat loss.

(3) The aid must function properly at an air temperature of -30 °C (-22 °F) to +20 °C (68 °F).

(b) *Donning Time.* Each thermal protective aid must be designed to enable a person to don the aid correctly within one minute after reading the donning and use instructions described in § 160.174-15(a).

(c) *Storage Temperature.* A thermal protective aid must not be damaged by storage in its storage case at any temperature between -30 °C (-22 °F) and +65 °C (149 °F).

(d) *In water performance.* The thermal protective aid must be designed to permit the wearer to remove it in the water within two minutes, if it impairs ability to swim.

(e) *Water penetration.* The fabric from which the thermal protective aid is constructed must maintain its watertight integrity when supporting a column of water 2 meters high.

(f) *Oil resistance.* Each thermal protective aid must be designed to be use-

able after 24 hours exposure to diesel oil.

#### § 160.174-13 Storage case.

Each thermal protective aid must be provided with a ziplock bag or equivalent storage case.

#### § 160.174-15 Instructions.

(a) Each thermal protective aid must have instructions for its donning and use in an emergency. The instructions must be in English and must not exceed 50 words. Illustrations must be used in addition to the words. The instructions must include advice as to whether to swim in the aid or discard it if the wearer is thrown into the water.

(b) The instructions required by paragraph (a) of this section must be on the exterior of the storage case, printed on a waterproof card attached to the storage case, or printed on the thermal protective aid and visible through a transparent storage case. The instructions must also be available in 8½×11 inch loose-leaf format for inclusion in the vessel's training manual.

#### § 160.174-17 Approval testing.

(a) *General.* A thermal protective aid must be tested as prescribed in this section.

(b) *Mobility and swimming tests.* The mobility and swimming capabilities of each thermal protective aid must be tested under the following conditions and procedures:

(1) *Test subjects.* Seven males and three females must be used in the tests described in this paragraph. The subjects must represent each of the three physical types (ectomorphic, endomorphic, and mesomorphic). Each subject must be in good health. The heaviest male subject must weigh at least 25 kg (55 lb) more than the lightest male subject. The heaviest female subject must weigh at least 25 kg (55 lb) more than the lightest female subject. The heaviest subject must weigh 150±5 Kg (330±11 lbs.) and the lightest subject must weigh 50±5 Kg (110±11 lbs.). Each subject must be unfamiliar with the specific thermal protective aid under test. Each subject must wear a standard range of clothing consisting of:

- (i) Underwear (short sleeved, short legged);
- (ii) Shirt (long sleeved);
- (iii) Trousers (not woolen);
- (iv) Woolen socks;
- (v) Rubber soled shoes; and
- (vi) A life preserver.

(2) *Donning test.* Each subject is removed from the view of the other subjects and allowed one minute to examine the thermal protective aid and the manufacturer's instructions for donning and use of the aid in an emergency. At the end of this period, the subject attempts to don the thermal protective aid as rapidly as possible. If the subject does not don the thermal protective aid completely, including gloves and any other accessories, within 60 seconds, the subject removes the aid and is given a demonstration of correct donning, and again attempts to don the aid. At least nine out of ten subjects must be able to don the thermal protective aid completely in 60 seconds on at least one of the two attempts.

(3) *Discarding test.* If the thermal protective aid impairs the ability of the wearer to swim, it must be demonstrated that it can be discarded by the test subjects, when immersed in water, in not more than two minutes. Caution: During each of the in water tests prescribed in this section, a person ready to render assistance when needed should be near each subject in the water.

(i) Unless the manufacturer specifies in the instructions that the thermal protective aid does impair ability to swim and should always be discarded in the water, each subject, wearing a life preserver, enters the water and swims 25 meters. The subject, after sufficient rest to avoid fatigue, repeats this test wearing a thermal protective aid in addition to the life preserver. At least nine out of ten subjects must be able to swim this distance wearing the thermal protective aid in not more than 125% of the time taken to swim the distance wearing only a life preserver, or the aid will be determined to impair the ability to swim.

(ii) If the thermal protective aid is determined by the above test or specified by the manufacturer to impair the ability to swim, each subject, after en-

tering the water from a height of one meter (three feet), attempts to remove the aid and discard it. At least nine out of ten subjects must be able to discard the device within two minutes.

(c) [Reserved]

(d) *Storage temperature.* Two samples of the thermal protective aids, in their storage cases, are alternately subjected to surrounding temperatures of  $-30^{\circ}\text{C}$  to  $+65^{\circ}\text{C}$ . These alternating cycles need not follow immediately after each other and the following procedure, repeated for a total of ten cycles, is acceptable:

(1) 8 hours conditioning at  $65^{\circ}\text{C}$  to be completed in one day;

(2) The specimens removed from the warm chamber that same day and left exposed under ordinary room conditions until the next day;

(3) 8 hours conditioning at  $-30^{\circ}\text{C}$  to be completed the next day; and

(4) The specimens removed from the cold chamber that same day and left exposed under ordinary room conditions until the next day. At the conclusion of step (3) of the final cycle of cold storage, two test subjects who successfully completed the donning test previously enter the cold chamber, unpack and don the thermal protective aids. The aids must not show any damage, such as shrinking, cracking, swelling, dissolution or change of mechanical qualities.

(e) *Water penetration.* A sample of the fabric from which the thermal protective aid is constructed is installed as a membrane at one end of a tube of at least 2.5 cm (one inch) diameter and 2 meters long. The tube is fixed in a vertical position with the membrane at the bottom, and filled with water. After one hour the membrane must continue to support the column of water with no leakage.

(f) *Insulation.* The material from which the thermal protective aid is constructed is tested in accordance with the procedures in ASTM C 177, ASTM C 518, or ASTM D 1518. The material must have a thermal conductivity of not more than  $0.25\text{ W/(m}\cdot^{\circ}\text{K)}$  (incorporated by reference, see § 160.174-3).

(g) *Test for oil resistance.* After all its apertures have been sealed, a thermal protective aid is immersed under a 100

mm head of diesel oil, grade no. 2-D as defined in ASTM D 975 (incorporated by reference, see §160.174-3), for 24 hours. The surface oil is then wiped off and a sample of the material from the aid is again tested in accordance with the procedures in ASTM C 177 or ASTM C 518 (incorporated by reference, see §160.174-3). The material must still have a thermal conductivity of not more than 0.25 W/(m-°K).

(h) *Seam strength.* The strength of each different type of seam used in a thermal protective aid must be tested under the following conditions and procedures.

(1) *Test equipment.* The following equipment must be used in this test:

(i) A chamber in which air temperature can be kept at 25 °C (73.4 °F)  $\pm 2$  °C (1.8 °F) and in which relative humidity can be kept at 50%  $\pm 5$ %.

(ii) A device to apply tension to the seam by means of a pair of top jaws and a pair of bottom jaws. Each set of jaws must grip the material on both sides so that it does not slip when the load is applied. Each front jaw must be 25 mm (1 inch) wide by 25 mm (1 inch) long. The distance between the jaws before the load is applied must be 75mm (3 inches).

(2) *Test samples.* Each test sample consists of two pieces of the material from which the thermal protective aid is constructed, each of which is 100 mm (4 inches) square. The two pieces are joined by a seam as shown in figure 160.171-17(m)(3). For each type of seam, 5 samples are required. Each sample may be cut from a thermal protective aid or may be prepared specifically for this test. One type of seam is distinguished from another by the type and size of stitch or other joining method used (including orientation of warp and fill, if any) and by the type and thickness of the materials joined at the seam.

(3) *Test procedure.* Each sample is conditioned for at least 40 hours at 23 °C  $\pm 2$  °C and 50%  $\pm 5$ % relative humidity. Immediately after conditioning, each sample is mounted individually in the tension device as shown in figure 160.171-17(m)(3). The jaws are separated at a rate of 5 mm/second (12 in/minute). The maximum force to achieve rupture is recorded. The average force at rup-

ture must be at least 225 Newtons (50 lb).

(i) *Tear resistance.* The tear resistance of the material from which a thermal protective aid is constructed must be determined by the method described in ASTM D 1004 (incorporated by reference, see §160.174-3). If more than one material is used, each material must be tested. If varying thicknesses of a material are used in the aid, samples representing the thinnest portion of the material must be tested. If multiple layers of a material are used in the aid, samples representing the layer on the exterior of the aid must be tested. Any material that is a composite formed of two or more materials bonded together is considered to be a single material. The average tearing strength of each material must be at least 45 Newtons (10 lb).

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#### § 160.174-23 Marking.

(a) Each thermal protective aid must be marked with the words "Thermal Protective Aid," the name of the manufacturer, the model, the date of manufacture or a lot number from which the date of manufacture may be determined, and the Coast Guard approval number.

(b) Each storage case must be marked with the words "Thermal Protective Aid" or the thermal protective aid must have a similar marking which is visible through a transparent storage case.

#### § 160.174-25 Production testing.

(a) Thermal protective aid production testing is conducted under the procedures in this section and subpart 159.007 of this chapter.

(b) One out of every 100 thermal protective aids produced must be given a complete visual examination. The sample must be selected at random from a production lot of 100 thermal protective aids and examined by or under the supervision of the independent laboratory. The sample fails if the visual examination shows that the aid does not conform to the approved design.